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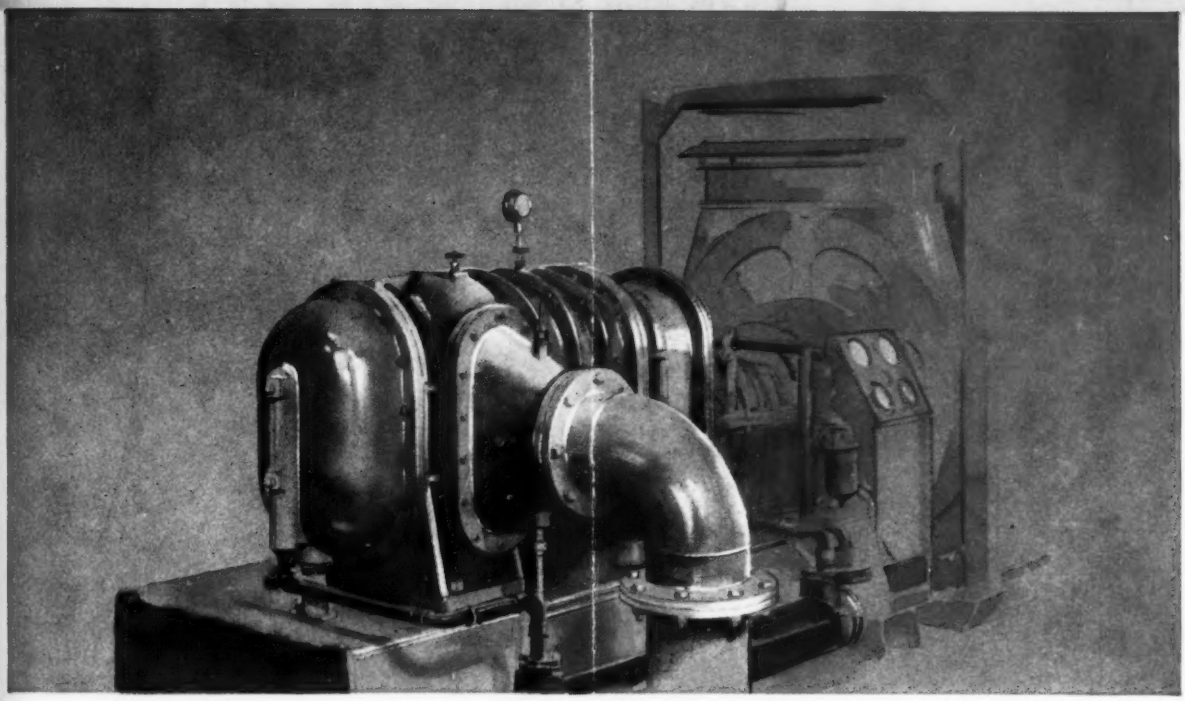

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The Mining Journal

London, August 28, 1959

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Zinc's Growing Strength

THE price of zinc has risen substantially in recent months and at the time of writing the L.M.E. quotations are at approximately their highest levels since May, 1957. This notable recovery from the 1956-58 recession is due mainly to the voluntary cuts in production and exports arising from the United Nations zinc and lead conference held in New York early in May this year. According to the official communiqué issued after the conference, the effects of these cuts would be to reduce the world surplus production, originally estimated at 120,000 tons for 1959, to 16,000 tons on an annual reckoning during the second half of this year, provided consumption remained the same.

World consumption has certainly not fallen in recent months ; on the contrary, it has shown a significant improvement, particularly in the U.S., where stocks of slab zinc in producers' hands had fallen by the end of June, 1959, to 169,386 s. tons compared with the peak figure of 257,911 s. tons at the end of July, 1958. During May this year, the latest month for which statistics are available, the U.S. consumed 86,600 s. tons of slab zinc, compared with an average monthly figure of 72,360 s. tons in 1958. The factors chiefly responsible for the higher U.S. consumption were increased consumption of zinc by American motor car manufacturers and a rising demand for galvanized steel from U.S. industry as a whole.

Outside the U.S. the improvement in consumption has so far been less impressive, but special high-grade zinc for diecasting purposes has been in sustained request. In the first six months of this year total U.K. zinc consumption rose to 165,202 l. tons, as compared with 154,603 l. tons in the corresponding period of 1958. Having regard to the high level of activity in the motor car and other industries and to the favourable indications for economic expansion in the months ahead, a further gain in zinc consumption may be expected for the second half of 1959. This also holds good for the O.E.E.C. countries.

Two unpredictable factors in the immediate outlook are the duration of the stoppage in the U.S. steel industry and its potential impact on zinc consumption, and—on the other side of the ledger—the extent to which U.S. zinc production may be curtailed by the strikes in the copper industry. These uncertainties apart, it is reasonable to assume that world consumption of zinc will show a further improvement during the second half of 1959, and that by the end of the year the estimated surplus of 16,000 tons (in the annual rate of supply, as reduced by the voluntary cuts) will have been largely or wholly absorbed.

This transformation has come about far more quickly than seemed probable at the beginning of the year, when the prospect of collective action by producers seemed remote, but so long as capacity remains well in excess of world requirements, the industry's recovery cannot be regarded as complete. Some reserve capacity is, of course, wholly desirable in order to maintain consumer confidence in the adequacy of future supplies.

One of the most remarkable features of the world zinc industry, to quote Mr. John Rodgers, M.P., Parliamentary Secretary to the

Board of Trade, is its rate of growth. World production last year was nearly double that of the peak year before the last world war—1929. On the consumption side, data of the American Bureau of Metal Statistics indicate that the world zinc consumption outside of the U.S. in 1947-1949 averaged 1,085,000 s. tons annually, whereas today it is at a level of 2,110,000 s. tons annually—an increase of 94 per cent within ten years. In the U.S. consumption rose from an average of 770,000 s. tons in 1947-49 to a peak of 1,119,800 s. tons in 1955, from which it declined to 868,300 s. tons last year.

According to a recent survey by Government economists, indications point to a rise of 15 per cent in the total U.S. zinc consumption for 1959 over the recession level of 1958. Outside the U.S. a gain of 5 per cent in consumption and in exports to the U.S. is foreseen.

The medium-term projection assumes that consumption will grow in the 1960's at an average rate of a little less than 4½ per cent per year. Assuming no change in the quota system or stockpiling after 1959, the balance between supply and demand outside the U.S. should be achieved by about 1962, after which mine production would have to be expanded to meet production gains.

The further assumption is made that, if U.S. quotas are not removed in the next few years, U.S. demands would require a level of U.S. mine output in the early 1960's at least as great as the post-war peak level of production in the early 1950's. In order to encourage output of these amounts of metal, the price of zinc in the U.S. is likely to have to rise far above prices prevailing outside the U.S., creating problems for the domestic fabricating industries. It is believed that this situation should result in pressure to liberalize the quotas in the early 1960's.

On the basis of this study zinc's outlook must be regarded as extremely promising. Apart from the steel strike in the U.S.—which, at worst, is unlikely to cause more than a temporary set-back to zinc consumption—the short-term outlook is also far from discouraging, always providing that producers can resist the temptation to step up output before the market is capable of absorbing an increased supply. Should the present upward trend in consumption continue, it might not be long before some increase, expecially in the grades used for diecasting, could safely be contemplated.

STEEL IN THE ATOMIC AGE

In the race for industrial expansion which has been a conspicuous feature of world economy during the post war period, the steel industry has consistently maintained a leading position. The recent recession was principally due not to any substantial decline in requirements, but rather to the fall in the prices of primary products and the consequent diminution in the purchasing power of the less industrialized nations.

Already there are indications of the steel industry's emergence from a setback which is now perceived to be of a merely temporary character, and it is noteworthy that the pace of expansion of capacity has not been halted. On the contrary, intensive study of long-term trends has strengthened the conviction that more and still more steel will be required, and in the under-developed countries as well as in the leading steel-producing states, enormous capital expenditures have been allocated for further productive expansion.

Technological trends, however, have spread the conviction that mere expansion of bulk outputs of steel is not the sole or even the most pressing requirement. New processes of production, new types of steel to meet the needs of the atomic age and to fulfil the more mundane purpose of reducing costs, are constantly being evolved, and in some cases have already been adopted.

Immense progress has been made in the practical application of the theory of powder metallurgy. The Republic Steel Corporation of America has evolved a new process for rolling steel strip from powdered iron particles thereby by-passing expensive coking plants, blast furnaces, open hearths, soaking pits and blooming mills.

It is too early to forecast the supersession of more conventional methods of steel production. The new process is still in an experimental stage, but Republic has been emboldened to authorize the construction of a pilot plant at its research centre and world attention will no doubt be concentrated on the results, whilst other processes for the direct manufacture of steel from pre-treated iron ore are being investigated.

In France M. Francis Perrin, Atomic Energy High Commissioner, has drawn attention to the possibilities of special steels in the atomic industry which promise substantial economies in cost. He instanced the development of the Séjournet extrusion process, which has shown itself capable of absorbing nuclear radiation in a satisfactory manner when used as a sheath only one tenth of a millimetre thick.

As an encouragement for further progress in the production of special steels for special purposes, M. Perrin also holds out the promise of the replacement of high priced metals such as zirconium and beryllium and sensibly advocates the grouping of scientific knowledge and research with this end in view.

In this country the most interesting development is the positive decision of two important steel companies to instal under licence the Austrian steel production system known as L.D. — Verfaboren. Richard Thomas & Baldwin hope to have the first unit operating at Ebbw Vale, and Colvilles, the Scottish steel giants, are also committed to the adoption of the system to supersede the bessemer converters.

This, of course, does not exhaust the list of new processes in course of evolution or investigation. Enough has been said, however, to indicate that the industry may be on the brink of a metallurgical revolution, and that, apart from the huge expenditures on expansion of capacity, steel makers may need big capital resources to meet the challenge of new steel-making techniques.

ITALY'S URANIUM PROGRAMME

According to a recent statement by the Italian National Nuclear Research Committee—Comitato Nazionale Ricerche Nucleari (CNRN)—the production of uranium metal in Italy should reach an annual total of 160 tonnes by the middle of 1961 ; this should increase to 350 tonnes p.a. by the end of 1962, valued at 12,000,000,000 lire. These estimations originate from close surveys of uranium-bearing sites made on behalf of CNRN in the Cottian Alps (to the south-west or Turin as far as the French frontier) and in the Maritime Alps (to the south of the Cottian Alps as far as the Mediterranean coast on the Italian side of the frontier), and particularly in the region of the town of Cuneo ; also in northern Italy, in the Val Gardena, alternatively known as Grodnertal, an Alpine valley to the north-east of Bolzano (Bozen) ; i.e., to the south of the Brenner Pass on the Italian-Austrian frontier.

It has been stated that in the Permian layers of the Cottian and Maritime Alps the existence of 100,000 tonnes of uranium-bearing rock with an average uranium metal content of 0.15 per cent equivalent to some 110 tonnes of metal, has been established; there are also probable reserves of 500,000

tonnes of uranium-bearing rock, and the possibility of still larger reserves. Elsewhere, in the Permian sands of the Val Gardena the existence of some 50,000 tonnes containing 73 tonnes of uranium metal has been proved, and here again the probable and possible reserves are extremely large.

It is believed that it will be possible to produce from the deposits in the Cottian and Maritime Alps at least 65 tonnes of uranium metal in 1960, and to start uranium-mining in the Val Gardena in the same year.

FAVOURABLE GEOLOGICAL INDICATIONS IN FIJI

Since gold-mining commenced in Fiji three companies have treated over 3,500,000 tons of ore from which over 1,750,000 fine ozs. of gold and nearly 500,000 fine oz. of silver have been recovered. This is revealed by Mr. D. T. Lloyd, Director of Lands, Mines and Surveys in his annual report, which states that gold produced in Fiji last year was valued at £1,193,419, compared with £1,017,808 in 1957.

The value of manganese produced in Fiji in 1958 fell from its 1957 figure of £470,207 to £262,892. In spite of this set-back, attributed to the fall in the price of ore, Fiji manganese mining has developed remarkably in the last ten years. In 1949, only 100 tons, worth £1,200, were exported. Last year, exports totalled more than 20,000 tons, worth over £342,000.

Fiji's mining industry last year contributed a total of £38,798 to government revenue.

The value of production from mines and quarries—in addition to gold and manganese—was : silver, £8,883 (compared with £8,858 in 1957) ; copper ore £3,034 (£4,665) ; limestone, £40,254 (£31,145) ; road metal, £103,928 (£76,056) ; iron ore, £8,931 (£3,900) ; sand and gravel, £89,400 (nil) ; coral sand, £17,761 (nil). The number employed in the industry in 1958 was 2,398.

On January 1 the Fiji Geological Survey attained Departmental status, states its report for 1958. Considerable progress was made during the year with regional geological mapping. The first geological sketch map of the Fiji Islands was produced on a scale of 1 : 500,000. Besides systematic mapping, geologists undertook reconnaissance surveys over several new regions including Tonga.

With the discovery of eight additional base metal deposits (zinc, copper and lead associated with gold and silver) in western Viti Levu, coupled with three deposits found in Tailevu during ordinary geological mapping, it becomes increasingly possible that, although individual Fijian deposits of base metal and gold are usually small, the overall tonnage may be considerable. Bearing in mind that these discoveries were made in stream exposures and road-cuts alone, it is apparent, statistically, that many more deposits are in existence beneath heavy undergrowth, weathered surfaces, and soils covering nine-tenths of the mapped areas.

It is geologically significant that both Tailevu and western Viti Levu are at the opposite ends of the major S.W.-N.E. trending axis of Viti Levu. This axis, composed as it is of sediments and volcanics intruded by a granitic batholith, could be expected to yield base metals and gold, on what amounts to about one-half of the area of Viti Levu. In addition, slightly radioactive base metals have been discovered on Vanua Levu in a younger sequence of acid volcanics, which, geologically speaking, greatly increases the areal extent of rocks likely to be mineralized.

Since delineation and, it is hoped, exploitation of this postulated metallogenetic province is beyond the means of private individuals, the report recommends that it should be undertaken by a large organization utilizing the latest geochemical and geophysical techniques.

During 1958 the Government agreed to assist the gold mining industry with a subsidy of £F2 per oz. of gold up to £F150,000 a year. Last year the Emperor gold mine at Vatukoula exported gold and silver of a value exceeding £1,200,000. The gold occurs mainly as tellurides. Company geologists, working to a well-planned programme, are gaining a much better understanding of this extremely complicated "basin" structure. New mineralized areas continue to be discovered. Government geologists assisted with petrographic determinations and regional mapping in the Wainivesi area, over part of which the company holds a large prospecting licence. During 1959 further assistance will be given by geological mapping in north Viti Levu.

Other mineral occurrences mentioned in the report include barytes, beach and other sands, copper, iron, limestone, bauxite, phosphate, salt and zinc.

SOUTH AUSTRALIA'S ORE TESTING LABORATORY

The South Australian Government possesses an ore testing laboratory of high standard, which was established at a high level during the uranium boom. The laboratory can carry work through from the laboratory scale to pilot stage.

Since then, the recession in work and the cost of running, has become more onerous than the State feels justified in financing, writes our Australian Correspondent. Steps are now well advanced to expand the laboratory into an Australia-wide organisation, not confined solely to the mining industry, but prepared to investigate and advise on the problems of industry generally. This is to be financed by guarantees from the various industries, and the mineral industry of the State of South Australia, and the Commonwealth Government are prepared to contribute a substantial sum towards the running of the laboratories in return for a share in the management and control. The undertaking will be controlled by an independent authority, in which the two Governments will be represented.

The response to the scheme for finance appears to have been very satisfactory and the continuance of operations as planned will be of very great value to the country ; there is excellent equipment and a highly trained technical staff.

CZECH COALFIELD DEVELOPMENT

According to reports by the Czech Government Press Service in Prague, the exploitation was begun last year of new coal sites which will provide an extra annual hard coal production of 75,000 tonnes and of a further 3,800,000 tonnes of brown coal per year. The output of coal is to be increased in the future, runs the Czech statement, with the aid of 80 newly-designed giant coal-mining machines with an output of 2,500 cu. ms. of coal per hour, as well as numerous shovel excavators of 3 cu. m. capacity which are now being brought into use. With the extension of the country's heavy engineering industry, the Czech production of metals is to be raised, too, particularly in the province of Slovakia.

An important step in the modernisation of the Czech coal mines has been the development, last year, by the country's heavy machinery branch, of the K300 type giant shovel excavator. For open-cast mining work, which in Czechoslovakia with its large brown coal reserves is a most important branch, the excavator has an hourly shifting capacity of 1,000 cu. m. per hour.

Record Mineral Exports from Cyprus

A RECORD quantity of mineral products was exported from Cyprus during 1958, states the Inspector of Mines in his annual report. At 1,236,657 tons, exports compared with 1,197,362 tons during the previous year, but the lower prices received for copper and sulphur products had the effect of reducing the total value from £10,440,691 to £9,124,250.

There were no amendments to the Mines and Quarries (Regulation) Laws, 1953 and 1956, during the year, but Regulations made under Section 46 of the Law of 1953 came into operation on October 1. Whereas previously the terms and conditions of each individual lease or licence were the subject of negotiations between the Government and the lessee, provision is now made for the payment of fixed surface rents and royalties on all similar leases or licences. In the main royalties call for a nominal payment only and the Government's revenue from mining will, as in the past, depend primarily on the profitability of the operations and will be collected as income tax on company profits.

No new deposits were discovered during the year.

Progress of Mining Operations

The Cyprus Mines Corporation exported 782,920 tons of products during 1958. There was no production during 1958 from the Skouriotissa Mine, but some underground check sampling was carried out. On surface, towards the close of the year, a heavy-duty bulldozer was used for the construction of a new access road to facilitate commencement of the proposed plan for stripping the overburden before restarting mining operations by the opencast method. It is estimated that it will take approximately 3 years to strip the overburden and prepare the deposit for production.

The rehabilitation programme at the corporation's Apliki Mine, started in 1957, was completed in September last year, some 2,400 ft. of galleries and 380 ft. of raises being rehabilitated. By the close of the year 225 ft. of crosscuts had been driven.

At the Mavrovouni mine 817,710 tons of ore were extracted and railed to the treatment plant at Xeros, compared with 923,831 tons during 1957. There was a corresponding decrease in the amount of development work. Ore extraction was completed at three further levels and at the close of the year all operations were at or below minus 104 ft. below sea level.

The total tonnage of pyrites exported by the Hellenic Mining Co. Ltd. during 1958 amounted to 323,339 tons of an average grade of 0.35 per cent copper and 47.20 per cent sulphur.

With more labour available than during the previous year, Hellenic continued underground operations on the Kalavasos orebody, while the remainder of the deposit at Platies was extracted by opencast methods. At Mavri Sykia opencast operations were continued, but an extension to the orebody was discovered at the bottom of the pit and subsequently developed by underground methods. Underground development work at the Kalavasos Lease amounted to 63 ft. of shaft sinking, 955 ft. of drives and crosscuts and 433 ft. of raises and winzes. A total of 121,043 tons of ore were mined and on treatment yielded 88,059 tons of commercial grade ore.

The reorganization of Hellenic's Kambia opencast mine continued and some 185,733 cu. m. of overburden were removed. Very little work was done on the Kapedhes opencast mine, but at Sha operations were more extensive. Total exports from the Kambia-Sha lease area amounted to 82,315 tons.

At the Kokkinopezoula mine the stripping of overburden proceeded smoothly and some 1,974,884 cu. m. were removed. Simultaneously underground operations were continued on a small scale. From the Agrokipia opencast mine 691,394 cu. m. of overburden were removed and 98,295 tons of low-grade ore extracted. At the new Agrokipia mine the subsidiary vertical shaft was completed and a through connection made, at 240 m. above sea level, with the incline shaft. Development of the deposit was then commenced on this level. Subsequently a further level was driven in the direction of the orebody from the incline at 190 m. O.D. and this level was approaching the limit of the orebody at the close of the year. From initial development work on the 240 level, 1,134 tons of high-grade ore were extracted.

Exports by Cyprus Sulphur and Copper Co. Ltd. during 1958 comprised 61,417 tons of cupreous pyrites, 6,543 tons of iron pyrites, and 256 tons of cement copper.

No ore was extracted from the Limni deposit, but during the early months of the year the installation of the leaching plant was completed. Production of cement copper commenced in May and by the end of the year 339 tons averaging 76.95 per cent copper had been recovered.

In its latest progress report, Cyprus Sulphur and Copper states that, following tests, it has been decided to resume milling operations on the Limni ore. Initially 400 to 600 tons per 24 hours will be treated using all-flotation plant. Good profitability is expected from the new project over the next four or five years which it is stated will provide work for more men and will not require any new plant or major capital expenditure.

Extraction of the high grade ore from Kinousa mine was completed after 929 tons had been mined during January. Recovery of equipment was completed by the end of March, the shaft and adit openings being sealed. It is estimated that some 100,000 tons of disseminated ore averaging 0.69 per cent copper, 0.42 per cent zinc and 39.07 per cent sulphur, which is at present an uneconomic proposition, has been left in the mine.

Two excavators worked throughout the year on the Kinousa opencast mine, 266,224 cu. yd. of overburden being removed, and 90,580 tons of ore averaging 3.14 per cent copper and 47.7 per cent sulphur were extracted.

Asbestos and Chrome

More favourable climatic conditions during the summer season helped to increase production by Cyprus Asbestos Mines Ltd. at the Amiandos asbestos mine, situated in the Troodos mountains, which rose to 8,955 tons of long grade (7,464) and 5,772 of short grade fibres (5,949). The use of heavy-duty bulldozers on the face has practically eliminated the need for explosives.

The Cyprus Chrome Co. Ltd., whose mine is situated on the northern slopes of Mt. Olympus, continued operating throughout the year and as labour was more easily recruited good progress was made. Exploratory work from the 17th level adit having indicated the persistence of the ore in depth, it was decided to drive a new low level adit, 5,000 ft. long and 500 ft. below the level of the existing 17 level adit. Work on this major project commenced in December.

The West of England Batholith

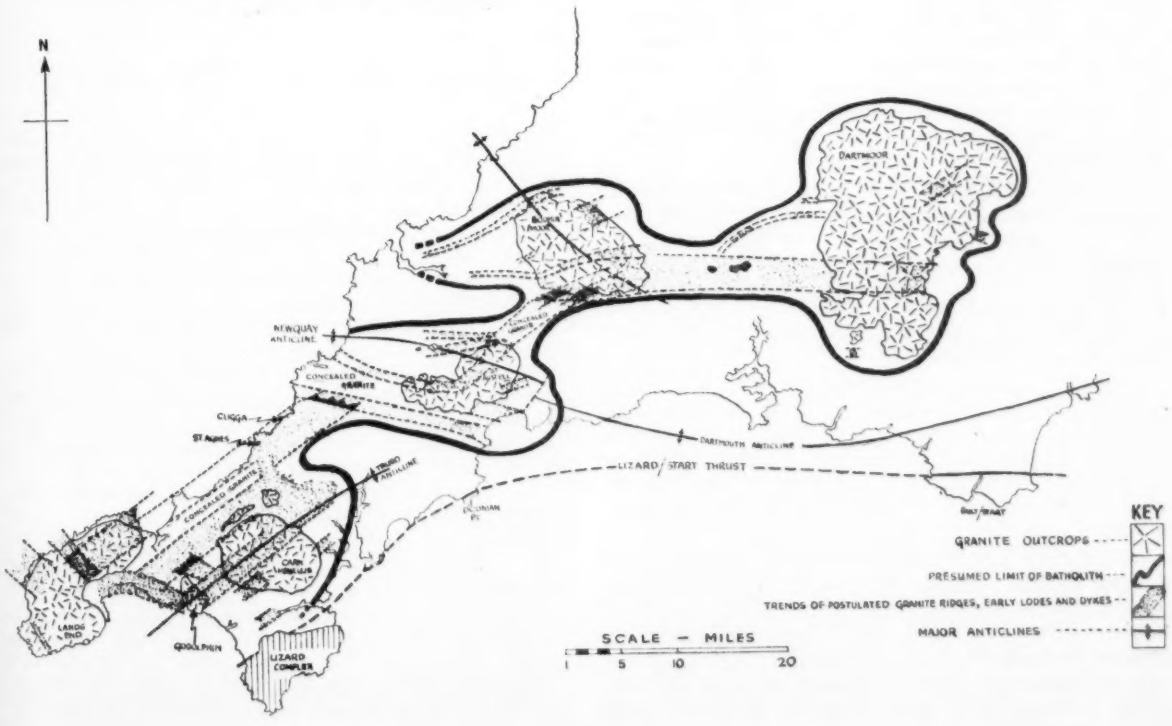
Independent investigators using different methods have arrived at similar conclusions regarding the form of the West of England batholith, with which the distribution pattern of hypothermal mineralization appears to coincide

IN a paper entitled "The Mineral Potential of Cornwall," presented at the recent symposium on The Future of Non-Ferrous Mining in Great Britain and Ireland, K. F. G. Hosking and J. H. Trounson point out that in the south-west of England hypothermal (Sn/W/Cu) mineralization is most intense in the Godolphin/Carn Brea/Carn Marth/St. Agnes zone and decreases progressively to the SW and the NE. This distribution pattern, in which the most intense hypothermal mineralization is approximately coincident with the centre of the granite batholith, can be matched elsewhere, and in the authors' opinion, is the one which might be expected to develop.

It is believed, states the paper, that the fundamental characteristics of the Cornish dyke/hypothermal lode pattern can be accounted for by assuming that these lodes and dykes are for the most part orientated approximately parallel to the long axes of granite ridges which possess undulating crest lines. (It is, however, probable that some of the lodes—particularly those with anomalous strikes—are essentially pre-granite faults which were subsequently mineralized.) It is considered that the disposition of these ridges was determined largely by the moulding action of minor anticlines which were present in the country rock invaded by the granite, and which were generally parallel to the Lizard/Start Point thrust. Doubtless the same forces caused the development of the thrust and the anticlines. Further "moulding" anticlines were developed by the rucking of the sedimentaries due to the emplacement of certain closely spaced large granite knots in the major anticlines. Thus, it is thought that such anticlines were formed in the Mounts Bay coastal strip sedimentaries by the compressive rucking forces which developed as a result of the simultaneous development of the Land's End and Godolphin granites.

As a result of forces operating from the south during the development of the batholith, "fingers" of granite were forcibly intruded into the country rock to the north of the major granite knots and associated with these are certain approximately N-S striking lodes, of which that at Castle-an-Dinas is one of the best known. Furthermore, it seems probable that centres of mineralization developed where there were "high-spots" (cusps) on the ridges. (In this connection the authors instance the development of lodes round the cusps of St. Agnes, Carn Brea, Kit Hill and Hingston Downs.) Greisen-bordered veins often developed first in such places from the local residuum which accumulated in such traps

Sketch map of south-west England, published by courtesy of the Institution of Mining and Metallurgy, and showing the presumed form of the batholith, together with the general trends of the early lodes, dykes and the postulated controlling granite ridges



during the consolidation of the ridges. Subsequently the lodes of economic importance were formed from the heavy-metal differentiate which accumulated below the highest points of the roof during the consolidation of the "body" of the batholith. It is reasonable to expect that these centres of accumulation were below the cusps of the ridges. Observation suggests that in a given area of limited extent the most intense mineralization was associated with the largest of the granite cusps.

Finally, it is stressed that there is considerable evidence for the existence of concealed granite in certain areas far removed from the surface granite masses, and, therefore, the general form of the granite batholith can be predicted with considerable confidence.

These views are supported by the results of a geophysical investigation reported by M. H. P. Bott, A. A. Day and D. Masson-Smith ("The Geological Interpretation of Gravity and Magnetic Surveys in Devon and Cornwall" (Philosophical Transactions of the Royal Society of London, Series A. Mathematical and Physical Sciences, No. 992, Vol. 251, pp. 161-191, December 4, 1958)). Though the form of the West of England batholith is arrived at by different means, the results are to all intents and purposes the same.

Bouguer Anomalies

The main feature of the gravity field of Devon and Cornwall, state the authors of the second paper, is a belt of large negative Bouguer anomalies which follows the line of the granite outcrops. These low anomalies are shown to originate from a shallow structure and are interpreted as being caused by the relatively low density of the granite itself. They indicate that the exposed granites are cupolas on a single elongated batholith which reaches a depth of at least 8 km. and possibly 20 km. The magnetic anomalies between Dartmoor and Bodmin Moor support the idea of interconnection. A more detailed interpretation of the gravity anomalies shows that the contacts between the granite and the enveloping country rocks generally slope outwards. For Dartmoor, at least, the base of the batholith seems to be deeper in the south. A mechanism of emplacement combining forcible intrusion with stoping, in which the magma rose in the south, is consistent with the shape suggested. In marked contrast to the granites of the mainland and Scilly Isles there is only a small drop in the Bouguer anomalies over the Lundy granite, suggesting a laccolithic space form.

The present high ground corresponding with the granite exposures of the mainland is shown to be isostatically compensated, or even over-compensated, by mass deficiencies implied by the negative anomalies. Since the anomalies seem to be caused by the low density of the granite, the compensation is almost certainly caused by the relatively low density of the batholith itself. The depth of compensation is unusually low at about 10 or 15 km.

There is a marked southward increase of the Bouguer anomalies over the Start and Lizard peninsulas which is thought to be related to the presence of a thrust affecting these regions. Similarly, the northward decrease of the gravity anomalies across Exmoor is attributed to a major overthrust beneath which a great thickness of Carboniferous and Devonian rocks is likely to be present.

Over the Culm synclinorium three east-west ridges of higher Bouguer anomalies are superimposed on a westerly regional gradient and are shown to be of shallow origin. The high magnetic anomalies in this area suggest the presence of magnetic rocks extending to a considerable depth.

A smaller gravity "low" coincides with the Crediton trough of Permo-Triassic rocks. A detailed traverse at North Tawton indicates that the trough here is V-shaped and has a maximum depth of 340 m.

A belt of mineralization, which was once of considerable economic importance, follows the length of the granite belt. Along the eastern part of its course it is displaced to the south of the axis of the minimum gravity anomalies. It is also displaced here to the south of the granite exposures.

Bott, Day and Masson-Smith, in common with Hosking and Trounson, consider that a connection exists between the granite belt and the mineralization, although the exact relations are not clear. Hosking has suggested that the mineralization is caused by unexposed granite ridges, and there is a close general correlation between these postulated ridges and the interconnecting granite ridge suggested by the gravity anomalies. It is thought, however, that if the patches of mineralization *south* of the main granite ridge are caused by proximity of granitic material, then it must be in the form of thin sheets occupying only a small proportion of the total country rocks ; sheets more than 200 m. thick should produce a detectable anomaly.

It is considered possible that the peculiar position of the belt of mineralization is related to the asymmetry of the granites. Thus the mineralization may be connected with crustal or magmatic conditions leading to or resulting from the apparently deeper floor in the south.

It is thus indicated that the granite continues below the sea in the St. Agnes area. Hence, if the submarine granite/slate contact can be delineated this summer, as planned, we may know rather more about the metal potential of this *new* area. If the observations on land are continued on a much closer grid, this might result in the location of granite cusps below the slate (e.g., between the Camborne-Redruth-Scorrier mining areas and the North Coast) which might be centres of economic mineralization.

It is noteworthy that in Malaya an airborne survey has almost certainly located such cusps to the west of the Main Range, and the adjacent highly stanniferous Kinta Valley (*vide*, *Economic Bulletin*, 1 - 1, Airborne Magnetometer and Scintillation Counter Survey over parts of Perak, Selangor and Negri Sembilan).

New Russian Ore Mine

Within the framework of the 1959-1965 seven-year development plan the production of iron ore in the U.S.S.R. is to be increased annually by an average of 9,000,000 to 10,300,000 tonnes of saleable iron ore, as compared with an annual increase of 6,200,000 tonnes during the 1952-1958 period. For 1965 the output is envisaged to reach 230,000,000 to 245,000,000 tonnes of iron ore (gross output) equivalent to 150,000,000-160,000,000 tonnes of commercial iron ore. To achieve this objective, existing iron ore mines are being modernized and rationalized, while a number of new iron mines have been opened or are being developed throughout the country. Among the largest of the new mines being opened up is the Mikhailovski mine, in the southwestern part of the Kursk province (halfway between Moscow and Kharkov in the Ukraine). Development work at the Mikhailovski mine has been going on for about two years, and production is to start early in 1960 when the annual output will total some 700,000 tonnes of high-grade iron ore. By the end of the seven-year plan production is calculated to reach an annual total of 4,500,000 tonnes.

The new mine is of the opencast type, and a large concentrating plant is being built nearby, as well as a mining town, to be known as Zheleznogorsk ("Iron Town"). Power for working the mine will be obtained from the Kursk thermal power station, some 68 miles away.

The Use of Reflecting Foils in Mining

This article is condensed from a paper by E. Davies, unit surveyor, Pentreclwydau Colliery, S.W. Division, National Coal Board

LIGHT reflecting foils have become extremely popular in all cases where it is desired to make objects visible in the darkness (which are not specially illuminated) by projecting a light at them, e.g. (as in road signs and advertising announcements). They are manufactured in five different colours (red, white, yellow, blue and green), and the foils, dependent upon their shade and colour, reflect 40-325 times as much as a white enamelled surface.

After having seen some examples of reflecting foil road signs and having had the privilege of carrying out some experimental observations of reflecting foil equipment at underground colliery workings, it was considered that the use of reflecting foils could be adopted for underground mining and tunnelling operations.

Reflective sheeting is a thin flexible, weatherproof light reflecting film, which can be durably mounted on practically any smooth non-porous surface. The reflecting film embodies millions of microscopic glass " lenses ", each of which is a perfectly formed sphere. When light strikes reflective sheeting, the minute lenses break up the light into small beams which are reflected directly back to the source of light.

The use of light reflecting foils is already known in the mines of America, France, Germany and Russia, and it is felt that its use can be introduced into the mines of Great Britain.

Warning Notices and Signs

It is quoted in the Coal Mines and Quarries Acts and Regulations, that specified warning notices and signs shall be posted up at points throughout the mine workings. These can be of two types, namely, a rear illuminated panel, or alternatively, the opaque type (i.e. an opaque panel with the wording painted on the face).

The rear-illuminated panel is by far the better, but to have every notice throughout the mine made to this type would not be practicable, because a power cable would require to be connected to each and every sign to give the necessary back illumination, so that the sign or notice could be read. Furthermore, to have all notices made to this type would prove to be most expensive, and they would always have to be kept illuminated, because, where any notice is posted up, it is meant to be visible at all times. If the mine experienced a power failure, all such notices would become ineffective and they would be a great inconvenience in the case of rescue work, etc.

The opaque panel type, which is most commonly used, varies considerably in types and most important in clarity. (e.g. black ground with white lettering, white ground with black lettering) and in the darkness it will be found that you have to stand quite near to the notice to read the contents, bearing in mind that the only means of illuminating the notice is by means of the miner's cap lamp worn by the individual.

It is felt that the two types of notices already discussed fall short of being effective for underground workings and as an alternative, it is proposed to describe a type of notice made up of reflective foil sheeting, which will be known as the R.F. notice or sign throughout this paper.

It is suggested that all underground notices and warnings be made up in reflective foils for the reason of their practicability, clarity, and the added safety they will offer. " R.F. Notices " do not require to be constantly illuminated, but they always appear as illuminated notices, when a beam of light from a miner's cap lamp strikes them.

Notices made up of foil will considerably facilitate the task of rescue workers strange to their surroundings, besides their great value to all underground workers in their everyday work routine. A further advantage can be achieved by the use of colour reflecting foils to indicate telephone points, electrical switchgear, warnings, directions, etc. Colour R.F. Notices would greatly contribute towards safety and clarity in operations especially if a standard code of colours be adopted.

Due to the universal introduction of the miner's cap lamp throughout the mines, it follows that each individual entering the mine has his own light source and each and every individual is in a position to have every notice or sign illuminated for him, due to the reflective powers of the foils.

Use of Colour

As an additional safety precaution in the mines, all underground signs and notices could be made up in reflecting foils of different colours and shapes. It would be sensible to suggest the use of the New British Standard No. 2929 Safety Colours for use in Industry, which deals with colours and shapes of industrial safety signs.

Below is indicated the B.S. No. 2929 Safety Colours and Shapes for the various types of notices in use at underground workings :

1. Order Signs:	Red circle with white lettering.
2. Caution Signs:	Yellow triangle with black lettering.
3. Emergency Safety Signs:	Red rectangle with white lettering.
4. Safety Information:	Green rectangle with white lettering.

It will be appreciated that a code of uniformity, with regard to the colours and shapes, will add to additional safety in the mines.

Why Reflective Foil Signs ?

The answer to this question has already been given by a prominent safety adviser, who states : " Signs must be readable at all times, under all conditions." Another safety adviser who has written of R.F. Signs states : " In the event of a power failure, R.F. signs are the only signs that fulfil the above safety adviser's statement. They are readable in the dark with the minimum of light and are visible with a torch through smoke and fog." Emergency squads can readily find necessary signs in surroundings to which they are unaccustomed.

It is considered that many more ideas will come to mind for the use of reflective foil in underground mining, to make objects, other than the notices already written of, visible in the darkness.

One idea which has been tried out at Pentreclwydau Colliery and which has proved successful, is that of making the miners' helmets visible by fixing a small strip of reflective foil to the back of individual's safety helmets, whereby, upon a light of another individual's cap lamp striking the back of the helmet of the person in front, that individual can be seen from behind up to a distance of approximately 50-60 yards ahead. This in itself can be considered an additional safety precaution for men working underground since it makes the

man visible from behind by means of the reflective foil on the back of his helmet, and automatically visible from in front by means of the cap lamp which he wears on the safety helmet.

This suggestion has already been taken up with the manufacturers of such helmets, who are assumed to be following up the idea by manufacturing safety helmets with reflective foils tabs fixed on to the helmet.

It is suggested that rescue station teams could have part of their rescue clothing made up of reflective fabric such as their belts, armlets, etc., which would make them visible at all times and in all conditions during their rescue operations.

Underground Roadways

With the introduction of modern mining machinery, the maintaining of straight roadways has become more important today than at any other time in the history of mining.

The method of determining ahead of the underground roadway or tunnel which is to be excavated in a straight line, consists of taking the direction or bearing by means of two flame safety lamps hung on the direction line previously established by the surveyor.

This necessitates the carrying of one or more flame safety lamps into the mine for the purpose of checking and extending the road alignment. The person carrying them will usually have to walk throughout the mine workings either to check or extend the road alignment at all roadways of the mine, and invariably in practice it is found that this particular person has to carry an appreciable amount of other equipment essential to his work.

The flame lamp used in the mines is known as a safety flame lamp, but when used by any unthinking person it can become a source of danger ; i.e. when relighted in the underground workings where unknowingly there is gas present. Also when flame safety lamps are used for road alignment, it will be agreed that technically speaking, one or more of these flame lamps are left unattended, which is contrary to the Coal Mines Acts and Regulations.

In view of these criticisms of the flame safety lamps for road alignment duties, road alignment tubes for the purpose of checking and extending the direction lines at underground roadways and tunnels have been designed. The tubes are made from a light alloy, hollow cylindrical tube, approximately 12 to 15 inches long and 1 inch in diameter, entirely covered with reflective foil, with a hook attached to each end of the tube. The hook at one end is used to suspend the tube from the existing direction line and the hook at the bottom is used to attach a string with a weight for steadying the tube itself in the wind current. The reason for not weighting the tube itself is to keep the weight down to a minimum. When it is found necessary to weight the tube so as to steady it due to wind currents in the tunnel, a stone or some other weight can be readily found near at hand.

The road alignment tubes are used in a similar way to the hanging lanterns or flame lamp method, in that they are suspended from previously established direction points. When it is required either to check or extend the direction line, the tubes are suspended on the previously established line and the person checking stands at the face of the tunnel and directs the beam of his cap lamp on to the tubes, which appear as strips of bright lights and can be seen quite distinctly up to distances of 150 yards. To complete the operation, all that is necessary is to line the string of a suspended plumb-bob with the strips of light, the point of contact of plumb-bob string with the roof of the tunnel becoming the new established point on the required direction line.

This method is extremely accurate, due to the clarity of sighting on to clear narrow strips of light of exceptional brilliance without glare, and it can be suggested that the road alignment tubes be of different colours, so that when they are suspended on the direction line at different heights and viewed in line, they then appear as a continuous strip of light of different colour.

Where any underground roadway or tunnel is being excavated to a pre-determined grade, it can be kept to grade by using boning rods with reflective foil faces. The actual lining up of the pre-determined grade is very much simplified as against the other methods now used, due to the clarity of the boning rods being sighted. There are many types of boning rods now used for this type of work and all that is required to make them really efficient is to have their faces made up in reflective foils.

R.F. " Faced " Levelling Staff

The levelling staff, which is in principle a graduated rod, is used in conjunction with the surveyor's level or telescope to ascertain the relative difference in height between two points. When levelling work is carried out underground, as in mining or tunnelling operations, the source of light is very limited and is always artificial light supplied by standard fittings of electric light, or, as is generally the case, by means of a miner's cap lamp. Thus a difficulty, only encountered in underground levelling, is, how to illuminate the levelling staff when used underground so that it can be seen through the surveyor's telescope.

The only means available to the underground surveyor is that of having a beam of light from a miner's cap lamp directed on to the face of the levelling staff. In practice, it will be necessary to hold the light source very near to the face of the levelling staff to give sufficient light for the staff to be seen.

When the profile of the ground which is being levelled is undulating, as is often the case in underground mining operations, and when the instrument man is ready to sight the levelling staff, it is necessary to give verbal instructions to one of the staff men to move the light source upwards and downwards along the staff face until the instrument man can pick up the light source at a position on the staff which is coincident with the height of collimation of the Surveyor's telescope, and again instructions are given to the staff men to slightly adjust the light source so as to give the strongest light at the required position on the staff.

To carry out this work correctly requires three men (i.e. one instrument man, one man to hold the staff truly vertical and one man to direct the light on the levelling staff). In view of the tediousness, irritability and, most important, the waste of time involved by this method, the author set about to find a levelling staff which could be illuminated along its graduated face, so that it could be seen as clearly underground as when used above ground.

One idea which was worked on was a levelling staff similar in all respects to the one now generally used (i.e. a three-sectioned sliding staff with the graduated face either engraved or painted on the face), with the exception that the graduated face is made up in reflective foil One such staff has been made and is now in use.

When a light source such as the miner's cap lamp worn by the instrument man is directed on to the levelling staff, the whole face of the staff is illuminated very clearly without glare, and can be read through the lens of the telescope up to distances of fifty yards. It might be suggested that this distance could be improved upon if a stronger power lens was used and another man was employed to project a light beam on the staff, standing at a position between the instrument and levelling staff and approximately ten to fifteen yards from the staff.

T.V.A's Quarter-Century of Development

ESTABLISHED by Act of Congress in 1933 to conserve the natural resources of the area and, by development, to make the fullest use of the river waters, the Tennessee Valley Authority completed the first quarter century of its history in 1958. Along with the development of hydro-electric and thermal power generation, navigation and flood control, has grown up a vast fertilizer-munitions development centre at Muscle Shoals, Alabama, claimed to be the only one of its kind, which is engaged in a wide range of research and development activities.

Development of Phosphate Production

To meet the needs of this fertilizer-munitions plant, large quantities of phosphates are required, and T.V.A. has contributed substantially to opening up the large phosphate reserves of the Western States to industrial utilization. Particularly prior to 1950, it co-operated actively with the United States Geological Survey, the Bureau of Mines and other agencies of the United States Department of the Interior interested in the conservation and development of the national phosphate reserves. A large number of chemical analyses were made of the phosphate rock for these agencies, and pilot plant tests of the suitability of western phosphate for processing were made on a reimbursible basis for private companies.

Between 1934 and 1958, T.V.A. has carried on research and development work on more than 25 fertilizer materials. In the course of this work it has been granted 113 patents. Of these 90 were on fertilizer and munitions developments, 13 on mineral developments and 10 on miscellaneous inventions. On the other hand, it had granted 144 licences to 122 different companies in respect of equipment and processes.

Mining operations in Tennessee provide nearly 50 per cent of the raw phosphate used in experimental fertilizer production at Muscle Shoals, but the Tennessee material is of comparatively low grade, and rock from Tennessee is now being mixed with purchased Florida rock to make suitable furnace charge. At the same time, T.V.A. has purchased phosphate land in Florida, some 957 acres being bought in the hard rock phosphate field in 1958 to bring the Authority's total holdings to about 2,860 acres. This represents an estimated 14 years' supply of high-grade phosphate at the current rate of consumption of Florida material.

Improvements in Furnace Design

The electric furnace method of smelting the phosphate ore was chosen by T.V.A. since there was ample electric power, and initially the art of smelting phosphate in electric furnaces was comparatively new and open to great improvement. Electric furnaces can also smelt lower grades of phosphates and thus offer opportunities for conserving the nation's phosphate reserves, which, though large, are ultimately exhaustible. Another reason why electric furnace smelting was chosen was that elemental phosphorus, an important munition, could be produced as an intermediate product in the manufacture of fertilizers, and this was in keeping with the dual purpose of the Muscle Shoals Chemical development.

By the time the United States entered the Second World War, four electric furnaces were operating and producing elemental phosphorus pure enough for munitions use. Two larger furnaces were added during the war. In time, a simple and economical cone mixer to combine phosphate rock and phosphoric acid was developed and concentrated superphosphates were produced, later to be followed by a number of polynutrient fertilizers.

By 1957, there were seven commercial phosphorus producers operating a total of 28 electric furnaces in the United States, and probably half the phosphorus furnaces built in the last ten years have been based on T.V.A. designs. There are now eight large furnaces in Montana and Idaho, and a third of the national production of 339,200 tons of elemental phosphorus production comes from them.

Major improvements in conventional furnace design include a monolithic roof and the application of the hot-gas precipitator for removing dust from furnace gases to produce clean phosphorus. A rotating furnace has been developed which requires less maintenance of furnace linings than stationary furnaces, consumes less power per ton of production and operates smoothly with a large proportion of fines in the furnace charge. One phosphorus producer, licensed to use several T.V.A. patented developments, has two rotating furnaces operating in Florida.

In 1952, the interest of the Atomic Energy Commission in the recovery of uranium from low-grade leached-zone phosphate ore in Florida, a material hitherto discarded in mining operations, led to the development by T.V.A. of a promising process for producing nitric phosphate fertilizer. After pilot plant studies, a demonstration scale unit is being built by T.V.A. to determine more fully the economics of the process and to provide material for agronomic tests. If needed, a step may be added in the process to recover uranium.

During the fiscal year 1958, some 70,100 tons of electric furnace by-products were disposed of, including expanded slag and granulated calcium silicate slag and ferro-phosphorus, the latter being sold to iron and steel manufacturers. A new process has been placed under plant trial to recover by-product fluorine for the manufacture of cryolite for the aluminium industry.

Encouragement of Mine Mechanization

The steam power generating plants of the T.V.A. consumed 17,000,000 tons of coal during the 1958 fiscal year. With the motive of assuring an adequate low-cost fuel supply, T.V.A. continued to encourage greater mechanization in mines and improvements of mining methods. A contract was awarded to a company in Tennessee for coal to be produced from experimental operation of an underground auger. This will be the first use of such equipment in the area supplying T.V.A. and, if successful, could lead to economical mining of some Tennessee coals where underground mining has virtually ceased because of poor roof conditions.

MINING MISCELLANY

West German experts have laid before the Indonesian Government in Djakarta a report they have made on the possibilities for underground mining in the country.

★

A credit of 300,000,000 roubles has been granted to Albania by the Soviet Union. It is to be used for geological surveys, for development of the mineral oil industry, and for various industrial schemes.

★

A large potash combine is to be set up at the year-old town and industrial centre of Novo-Starobinsk in Bylo-Russia. It will begin production in 1961. Potash deposits in the area are described as "inexhaustible".

★

Recent investigation has shown that the extensive nepheline syenite deposits in the Alta district of northern Norway are worth exploiting. The Norwegian concern, Christiania Spigerverk, hopes to start mining the mineral in the fairly near future.

★

A bill transferring the concession of the Ptolemais lignite mines in Greece from the original concessionaires, the LIPTCOL Co. controlled by M. Bodossakis to the Public Power Corporation and the National Bank of Greece, was recently approved by the Parliamentary Recess Committee.

★

Holman Brothers Ltd., have formed a Spanish manufacturing subsidiary company, Holman Iberica S.A. Holman pneumatic products have been prominent in Spain's mining, quarrying, civil engineering and general engineering industries for many years and the newly-formed company will ensure the continuity and expansion of this market which would otherwise have been affected by import restrictions. The new company has been established in conjunction with the Holman Spanish distributors—Maclaurin, Morrison y Cia. (S.A.), and their Spanish associates. So well have the initial plans been carried out that manufacture is already under way at Pinto, near Madrid, and the first portable compressor unit, pictured below, has been produced. This compressor, of 120 c.f.m. capacity, is powered by a Barreiros diesel engine of wholly Spanish manufacture. The compressor itself is built to Holman drawings and patterns supplied from Camborne, but unlike many locally-manufactured projects where the initial units are merely assembled from imported components, this compressor is completely of Spanish manufacture with the exception of the valve assemblies which have been imported from Britain.

★

A geologist of the atomic energy division of the Geological Survey of the Department of Scientific and Industrial Research has confirmed the discovery of uranium on the Scottish coast of the Solway Firth near Sandyhills, Kirkcudbrightshire. The find was on land belonging to Mr. O. H. Haslam.

★

A contract for the development of high purity metals of interest to U.S. missile and space programmes has been awarded by the Navy Bureau of Aeronautics to Alloyd Research Corporation. It calls for the design and construction of equipment capable of producing ultra-high purity molybdenum, tungsten, tantalum and chromium for research purposes.

★

Sylvania Electric Products Inc., a U.S. undertaking, has announced plans to expand production of molybdenum, tungsten and other refractory metals used in ultra high-temperature applications such as rockets, jet engines and industrial furnaces. Sylvania is a subsidiary of General Telephone and Electronics Corporation.

★

According to the latest figures released by the Indian Bureau of Mines, India's output of iron ore is expected to reach 7,500,000 tons this year, compared with 6,000,000 tons in 1958. Production during the first six months of the current year amounted to 3,700,000 tons. The rise is attributable to the improvement in exports and to better offtake locally.

★

The activities of private enterprise in the exploitation of Iran's mineral wealth are to be encouraged by a new bank formed in Teheran by private investors from the U.K., France, Belgium, West Germany, Holland, Italy and Iran itself with help from the World Bank. Mineral exploitation and the setting up of a petrochemical industry are among the activities which the bank will finance.

★

The steady improvement in the West German iron and steel market is having a satisfactory effect on the country's iron ore industry. This is indicated in a statement by one of the main ore producers, Erzbergbau Salzgitter AG, of Salzgitter, which reports sales for the second quarter of this year totalling 1,578,000 tonnes of ore, or 9.6 per cent more than in the first quarter of the year.

★

A contract for research and development on tantalum and tantalum-tungsten metal alloys for use as nozzles and other components in high performance solid fuel rocket propulsion systems has been announced in the U.S. by the National Research Corporation. The contract, awarded by the U.S. Navy Bureau of Ordnance, is aimed at the development of strong, erosion-resistant materials capable of operating at extreme temperatures.

★

Miferma, the international mining group in which the British Iron and Steel Federation has a 20 per cent share, has invited bids for preparatory work on the Fort Gouraud iron ore deposits in Mauretania. Preliminary bids have also been invited from contractors for building the 470-mile railway to connect Fort Gouraud with the Atlantic coast. Miferma has asked for a loan from the World Bank, from which it is hoped to obtain $65,000,000.

★

Anaconda Iron Ores (Ontario) Ltd., a wholly-owned subsidiary of the Anaconda Co., is to erect a pilot plant at the site of its multi-million dollar iron

The first Holman compressor unit manufactured in Spain

ore development near Nakina, Northwestern Ontario. It is expected that the plant, which will have a capacity of 100 t.p.d., will be completed next winter. The objective is to determine the metallurgical characteristics of the ores and to work out a final flow sheet under operating conditions.

★

A consortium of U.S. iron and steel firms is reported to have made a provisional offer to develop and exploit the Sierra Grande iron ore deposits in Patagonia, Argentina, and to establish an iron and steel works. The group was apparently agreeable in principle to invest about $150,000,000 in the scheme and to make its technical knowledge available on the basis of co-participation with Argentine companies, but stated that, since the project involved the establishment of a costly industry far from the consuming centres, it would have to be dependent on government support. The closing date for tenders for the exploitation of these deposits, already called for by Fabricaciones Militares, is September 30, 1959.

★

It is reported from Conakry that work has started in Guinea on exploration of the Nimba and Simandou iron ore deposits, which are believed to extend into that territory. Exploration is being carried out by geologists of the Bureau Minier de la France d'Outre-Mer working under orders from a group formed by the Bureau Minier itself, the British Iron and Steel Federation, and the ECSC authority. The Liberian American-Swedish Minerals Co. (LAMCO), which has explored the section of the deposits situated in Liberian territory, now places the potential at 240,000,000 tons of 65 per cent ore instead of 200,000,000 tons, as previously estimated.

PERSONAL

Mr. E. F. Elkan (British) has been appointed director of West Vlakfontein Gold Mining Co. Ltd.

★

Mr. George D. Bellows has been elected a vice-president of the Paul Weir Co., Inc., consulting mining engineers with head offices in Chicago.

★

Professor David Williams has been unanimously elected president of the Institution of Mining and Metallurgy for the session 1960-61 in succession to Dr. J. H. Watson. He will take office in May, 1960.

★

Mr. R. G. Baker, deputy chairman of the North-Eastern Division of the National Coal Board, has been elected president of the Institution of Mining Engineers for the year 1960-61. He will succeed Mr. T. A. Rogers in that office in January, 1960.

★

The board of the recently-formed Imperial Aluminium Co. has been constituted as follows: From Imperial Chemical Industries: Dr. James Taylor (chairman), Mr. Berkeley Villiers (managing director) and Mr. Michael Clapham. From Alcoa: Mr. DuBose Avery and Mr. F. J. Resch.

COMPANY NEWS

During the first week of September, the London office of the D.P. Battery Co. Ltd., will be removed to new premises at 137 Victoria Street, London, S.W.1. The telephone number and telegraphic address remain unaltered.

With effect from September 1, 1959, Birlec is to establish a Midland Area sales office with Mr. H. J. Podmore as manager. The new office will be situated at the company's main premises in Tyburn Road, Birmingham, 24.

★

In the face of international competition the N. C. K. Rapier Sales Co. has obtained an order for five NCK-RapieR 605 excavators from a large iron-ore mining company in Chile. Before the fifth machine had been delivered, an order for a sixth one was placed. The excavators are being used in a mountain area where there is an exceptionally high yield of iron ore.

★

Parkinson Howard Ltd., have been awarded the contract for the access roads for the Volta River Project preliminary works. The Employing Authority is Kaiser Engineers and Contractors Inc., and the Consulting Engineers are Sir William Halcrow and Partners. The value of the Contract is £420,000 and the work will be completed within nine months.

★

American Smelting and Refining Co., has announced that it will spend $43,500,000 over the next three years in developing an open pit copper mine and mill on its 250-acre property near Tucson, Arizona. The mill will be capable of handling 15,000 tons of ore a day and the mine is scheduled to produce 45,000 tons of copper annually when in full production.

★

Compoflex Co. Ltd., manufacturers of flexible tubing and hoses, announce the opening of a London warehouse at Angel House, Pentonville Road, London, N.1 (Telephone, Terminus 0533/4). Stocks held at this warehouse will include a range of Pirelli long length moulded rubber hoses, following an arrangement with the Pirelli Co. of Milan whereby Compoflex will undertake the marketing in the U.K. and Northern Ireland of certain long length hoses made by the Italian company.

★

Western Knapp Engineering Co., of San Francisco, has been awarded a contract to engineer part of a proposed $10,000,000 improvement and modification at the Utah Copper Division smelter of the Kennecott Corporation. The contract involves conversion of the present roasting process to a direct smelting process; modernization of the materials handling system; enlargement and modernization of the three reverberatory furnaces, and installation of new waste heat boilers. Other modifications will probably be scheduled later.

★

Universal-Matthey Products Ltd.—an associate company of Johnson Matthey and Co. Ltd., and Universal Oil Products Co.—has formed a subsidary company in Cologne, Universal-Matthey Products (Deutschland) GmbH, with a nominal capital of D.M.20,000. The object of this new enterprise is the manufacture of platinum catalysts to meet the needs of petroleum refineries employing the U O P platforming process in Western Germany and the Common Market countries. Mr. L. C. Montague and Mr. F. O. Newton have been appointed members of the Board of Administration, and Mr. A. E. Richards have been appointed manager.

★

Hunting Geophysics Ltd., is to undertake an extensive research and testing programme with the new Mullard electromagnetic detector installed in a Scottish Aviation Twin Pioneer. The testing programme is being carried out at the request of Rio Tinto, who are owners of the aircraft and for whom the Mullard equipment was developed. The Mullard unit is capable of distinguishing between potentially valuable deposits and poor conditions such as swamp and saline overburden. Huntings will crew and operate the aircraft and its equipment, which also includes a magnetometer and scintillometer. The results of the tests will be reduced, mapped and evaluated by company's geophysical staff at Elstree.

★

The North-Western Division of the National Coal Board has ordered two sets of the Wigan Type 40 shaft signalling indicator for installation at the new Agecroft Colliery. One set is for four levels and has already been delivered; the other, for five levels, will be delivered early in September. The systems have assistants' interlocks at some levels and miniature repeater signal indicators are provided in the bank control desks. The system also provides changeover facilities between the MEN and COAL sides of the shaft. The Type 40 shaft signalling system has been installed at the Pye Hill, Mosley Common, Askern, Kingsbury and Prestonlinks collieries, all units having been ordered this year.

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Cory Brothers and Co. Ltd., a member of the Powell Duffryn Group, has acquired the share capital of MacCleaster Chemical Co. Ltd. The latter company will continue to operate under its own name and the present directors, Mr. N. R. MacCleaster and Mr. R. A. L. Thornton, will remain on the board. Additional directors appointed are Brigadier S. J. L. Hill (chairman) and Mr. John Wm. Davies, both also directors of Cory Brothers, and Mr. J. W. Franklin. The company's address is 8 Great Tower St., London, E.C.3. Telephone, Mansion House 4555. MacCleaster Chemical Co. Ltd., a private company formed four years ago, manufactures a range of anti-corrosion compositions for the protection of metal, which have widespread applications. It is intended immediately to expand the company's production facilities and develop its present organization to provide a comprehensive advisory service on all industrial corrosion problems.

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At the Kingston-on-Soar Gypsum Mines near Nottingham, Gypsum Mines Ltd. recently took delivery of a new Fordson Power Major industrial tractor. To Gillotts Garage Ltd., of Loughborough, fell the task of breaking down over two tons of complete tractor into units small enough to enter the 4 ft. x 4 ft. mine shaft for lowering, piece by piece, to the shaft bottom. Everything was satisfactorily fitted into the cage, including the wheels which, complete with tyres, had a total dia. of some 44 in. Some difficulty was experienced with the 22 cwt. transmission section. A quarter of a mile from the pit shaft, and 150 ft. below the surface, the tractor, which will be used for heavy haulage work, was reassembled by the light of miners' headlamps and a lamp rigged from a 12 v. battery. The tractor is to be fitted with a special filter device to counter the effects of exhaust gases in the pit workings. Maintenance will be carried out in the mine and this tractor will never again see daylight until one day, with its life's work ended, it will be broken down and returned in sections to the surface.

Machinery and Equipment

Low-Cost Silicon Mine Power Supply

A new low-cost portable silicon mine power supply, particularly useful in low seam mines as it is only 30 in. high (or 28 per cent lower in height than comparable Mercury arc rectifiers) is now available through the International General Electric Co. It consists of a rectifier car and a transformer car.

The Low-Boy silicon power supply is available in ratings from 300 to 750 kW. 275 to 550 volts d.c., and is designed to withstand 150 per cent of rated current for two hours or 200 per cent of rated current for one minute. Regulation is only 7 per cent from no-load to full-load and efficiency is 95 per cent.

The silicon rectifier car contains silicon diode compartments, cooling fan and d.c. switchgear consisting of automatic reclosing equipment, line disconnect and a d.c. contactor. The hermetically-sealed silicon power diodes do not age, and maintain their original high efficiency indefinitely. The contactor is specifically designed to withstand the opening and closing operations required in rugged mining service.

The transformer used with the silicon rectifier unit is a sealed dry-type construction, using sulphur hexa-fluoride, SF6, as a cooling and insulating medium. SF6 not only provides a more efficient and economical d.c. power but also assures maximum safety to operating and maintenance personnel because it is non-flammable, non-toxic and non-explosive. The gas also reduces the weight of the transformer to one-half that of liquid filled transformers.

Mounted on the front of the transformer car is a standard fused air interrupter switch that provides 10,000 amp. interrupting capacity and disconnects the rectifier in the event of a transformer fault.

SCREEN DECK FOR STICKY ORES

The Inland loose rod deck which can screen moist, sticky ores without blinding has been introduced by Allis-Chalmers for new and existing vibrating screens.

Comprised of free rolling loose rods which rotate as they vibrate, the new deck greatly increases production with reduced blast furnace fuel costs.

The loose deck rods have induction hardened ends to resist wear and abrasion. Installed at right angles to material flow in contrast to conventional fixed rod deck designs, the rods are held in place and accurately spaced by heat treated, alloy steel spacers. Replacement, singly or in groups is easy.

Rods rotate opposite to the rotation of the vibrating mechanism at 60 to 100 r.p.m. depending upon screen throw and speed. In handling ores, wet fines adhere to the rods thereby providing a thin protective coating which reduces the clear opening between them. The smaller openings, combined with rotation and secondary vibration of the rods, screen slope, and screen throw result in a finer separation.

Although developed specifically to overcome blinding in sizing iron ore, the Inland loose rod deck should be effective wherever the screening of moist, sticky materials is involved. It is available on new Allis-Chalmers screens as well as for converting all makes of existing screens already in the field now equipped with conventional screen surfaces.

ROTARY TORQUE ACTUATORS

Keelavite Hydraulics Ltd., have concluded an agreement to manufacture and sell in Europe and the U.K. the rotary torque actuator (ROTAC) units of the EX-CELL-O Corporation of America.

The first series to be made in this country will be the RN series. These are single and double vane units, fitted with needle roller bearings. The range provides torque ratings from 1,500 in./lb. to 92,000 in./lb. at 1,000 p.s.i. These compact, powerful units provide semi-rotary movement hydraulically controlled. The single vane models allow movement through an arc of 280 deg. The double vane models develop much greater torque for the same pressure, but the arc of movement is restricted to 100 deg. Crane booms and car-tipplers are typical uses of these units.

The range of Keelvatite/Rotac units manufactured in this country will be gradually extended. Meanwhile, to meet customers' special requirements, Keelavite are willing to import from the U.S.A. any unit not in the range at present manufactured by them.

A NEW HEAVY-DUTY CRANE

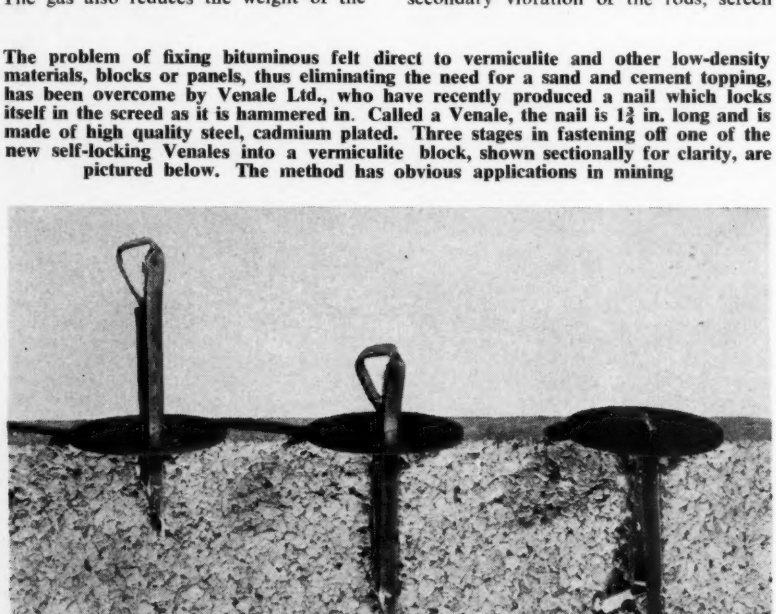
The new heavy-duty crane introduced by the N.C.K. Rapier Sales Co. Ltd., has been named the NCK-RapieR Pennine. This machine, made by Newton Chambers and Co. Ltd., is a completely new development.

By mounting the upper unit and lift crane attachment of the NCK-RapieR 20-ton truck crane on a special long and wide crawler frame there has been provided a crawler-mounted crane with a lifting capacity of 19 tons at 10 ft. radius with a 30-ft. pin-jointed boom. This boom can be extended by inserts to a maximum length of 90 ft. and special jib boom extensions up to 30 ft. in length with capacities of 5 tons are available for fitting on main booms up to 70 ft. in length. A pin-jointed boom, power-controlled boom lowering, power-controlled load lowering, a high "A" frame and pendant type boom suspension are standard equipment on this machine.

An important feature is that although the machine has been designed as a heavy-duty crane it can in fact be quickly converted for dragline, grabcrane and dragshovel duties.

Among the first Pennines delivered in this country — through the N.C.K. Rapier Sales Co.—was one to South Wales where it is being employed in the erection of a coal washery.

The problem of fixing bituminous felt direct to vermiculite and other low-density materials, blocks or panels, thus eliminating the need for a sand and cement topping, has been overcome by Venale Ltd., who have recently produced a nail which locks itself in the screed as it is hammered in. Called a Venale, the nail is 1¾ in. long and is made of high quality steel, cadmium plated. Three stages in fastening off one of the new self-locking Venales into a vermiculite block, shown sectionally for clarity, are pictured below. The method has obvious applications in mining



Technical Briefs

The Flotation of Chryscolla

Up to the present, no successful commercial flotation of chryscolla has been described and, indeed, very little has been published on the subject. The U.S. Bureau of Mines has reported two methods from synthetic ores. One consisted of sulphidization and a sulphydric collector at pH value of four when a 95 per cent recovery was claimed, although grade of concentrate was not given. The other procedure involved employing modified malachite green dye as a collector but recovery was much lower and grade of concentrate was low.

In *New Guides to Chryscolla Flotation*, by J. A. Jaeket, the writer points out that several years ago he found that 95 per cent could be recovered from synthetic as a 28 per cent concentrate, and more recently research has been undertaken to discover a less sensitive and more practical method.

As a result it has been shown that on synthetic ores it is possible to obtain recoveries of 80 per cent to 90 per cent in a concentrate carrying about 20 per cent to 28 per cent Cu., by the use of sulphidizing followed by flotation using aerofloat 31, a mercepto collector such as R404 or 425 and pine oil, provided the pH value is adjusted by sulphuric acid to 7.3-7.9.

It would appear that there is considerable tolerance to variation in the amount of collector employed although the amount of mercepto collector appears to be between 0.33 and 0.5 lb. per ton.

Experiments on an actual mine ore give similar recovery figures but a lower grade (10-13 per cent) concentrate and the best result was at a pH value of 7.5. As far as reagent consumption is concerned the amount of sodium sulphide required appears to be small, being in the order of 0.2 to 0.7 lb. per ton, but consumption of Reagent 404 including stage additions amounted to as much as 1.3 lb. per ton.

COMMERCIAL METAL DIFFUSION

In 1958, the patented Dicrom process of metal diffusion was first brought into commercial operation by Metal Diffusions Ltd., after many months of research, development and trial. This new process represents a very considerable advance on earlier metal diffusion techniques, and has overcome various defects and disadvantages previously experienced.

It is possible with the Dicrom chromizing process to produce a depth of diffusion of between 1/1,000 and 15/1,000 in., depending on the metallic analysis of the article treated. The function which the article is to perform determines the depth of diffusion which can be economically justified. The principal advantage of the Dicrom process is the high purity of chromium provided at the surface. This is always above 60 per cent, whereas earlier chromizing processes could rarely produce a surface purity of over 50 per cent. In fact, it has usually been claimed hitherto that chromizing will provide surface purity values up to 40 per cent, or up to 45 per cent. By comparison, surface purity values up to 96 per cent can be obtained with the Dicrom process; however, for most commercial applications, a depth of diffusion of from 3/1,000 to 5/1,000 in., with a surface concentration of chromium between 60 per cent and 75 per cent has provided very satisfactory results.

The superior surface properties obtainable with this process ensure that, in cases where special resistance to oxidation is required, at temperatures up to 1,180 deg. C., mild steel can be treated to afford the same resistance to corrosion as that afforded by a 40 per cent nickel /22 per cent chromium alloy steel—usually at between one-third and one-half of the cost. Employing combined chromium/aluminium diffusion, effective resistance to corrosion at temperatures up to 1,305 deg. C. is achieved by Dicrom treatment.

Hitherto, chromizing has been mainly employed as a means of increasing the life of grill-frets for gas stoves and of burner parts for paraffin-type domestic heaters. However, the higher percentage of surface chromium provided by the Dicrom process permits fuller use to be made of the physical properties of chromium — namely, its extreme hardness, its resistance to abrasion, its virtual immunity against oxidation or attack by many chemicals (including sulphuric and nitric acids) and its low co-efficient of friction — bearing in mind the wide temperature range over which all these properties are maintained. Furthermore, a Dicrom-chromized surface can be electro-polished to produce a finish comparable with chromium plating, while retaining the advantages of resistance to heat and of inseparability from the parent metal. The overall cost is also competitive.

Dicrom surface treatment is, therefore, of particular advantage for such uses as coal cutters, power transmission chains and gears, mechanical conveyors, ball and roller bearings, as well as exhaust systems for i.c. engines.

In the course of developing the Dicrom chromizing process, it was realized that the superior results associated with this new technique afforded an opportunity to produce thin chromium sheet. As an outcome of research work, it is now possible to produce this hitherto-unobtainable material with a purity as high as 96 per cent.

SANTA BARBARA UP TO DATE

The operations at Santa Barbara, Chihuahua, Mexico, have been brought up to date in a paper (IMM No. 627) by D. C. Shelton. The ore contains galena, sphalerite and chalcopyrite and flowsheet consists of first making a bulk lead and copper concentrate which is twice cleaned before making the lead - copper separation after conditioning with sulphurous acid and pH regulation using lime.

The zinc concentrate is floated in the conventional manner and after two stages of cleaning passed to a de-leading step where the sphalerite is depressed again using cyanide and zinc sulphate, allowing the galena which contaminated the zinc concentrate to be floated. This is then returned to the first flotation stage.

FLOATING COLUMBIUM-BEARING MINERALS

In U.S. patent 2,875,896 granted to two metallurgists at Kennecott Copper Corporation's research centre, it is claimed that a successful process for floating columbium - bearing minerals has been developed. The reagent used is 8-quinolinol but in some cases other members of the same family of reagents (for example 4-methyl 8-quinolinol) may give a better grade of concentrate.

Although the minerals can be floated without prior treatment, the grade of concentrate is low but if the flotation is preceded by calcite and and apatite removal in a flotation stage, followed by desliming, and another flotation step to remove mica and any sulphide, and lastly wet magnetic separation to eliminate magnetite, the flotation with 8-quinolinol will yield a concentrate of 10.36 per cent Cb_2O_5 or as high as 19.3 per cent Cb_2O_5 if 4-methyl 8-quinolinol is employed.

Agitation with aeration in the presence of the reagent (a commercial grade of which is used) and the reclamation of the reagent in the filtered effluents from both concentrate and tailing are cited as parts and advantages of the patent.

EQUIPMENT NOTES

Magnetic Engineering and Mfg. Co., United States, has produced a new high power cross belt magnetic separator using Memco - Hope design. Chief feature is the individual control through an adjustable magnetic circuit of each pole. The machine is available in sizes ranging from a 3 in. belt for laboratory use to one with a 24 in. wide belt which is said to have a capacity as high as 8,000 lb. per hr. on some separations.

Several Australian rutile and zircon producers are now using locally made fibre-glass spirals of their own design. It is also reported that fine zircon sand is being added to the surface of such fibreglass to improve its wearing qualities.

A new type of dense medium washer has been announced by W. J. Jenkins and Co. Ltd. Known at the Teska, it is being made under licence from Firma Schuchtermann and Kremer-Baum of Dortmund, Germany.

At the Otanmaki concentrator in Finland, ball mills are being lined in a novel manner; the shells are divided into three sections and are lined with rubber on which are set longitudinal steel ribs wedged into place by wooden ribs. These ribs expand during operation and lock the assembly into place. As a result of this design, weight and cost of liners is reduced and an increased liner life is reported due to the balls becoming partially embedded in the wood and standing proud above the metal bars, so that wear thereon is minimized.

Metals and Minerals

More Barter Deals Under Negotiation

In quiet chrome and manganese markets, in which the subdued trading tone is currently accentuated both by seasonal influences and by the steel strike in the U.S., there is little to report beyond the progress of various barter deals.

A barter transaction with the U.S. Commodity Credit Corporation involving a quantity in the range of 60,000-100,000 tons of 46 per cent manganese ore was recently negotiated. The ore, to come from Africa and India, and possibly also from Brazil, will be delivered next year at a date to be fixed later. The bulk of the ore is believed to be Indian. The single U.S.-Indian barter deal is still not completed, however, because of delivery and pricing difficulties. There has also been some talk of a large private barter deal involving chromite between the U.S. and Turkey, but details so far are lacking.

Meanwhile, India has concluded a barter agreement with France under which she will export manganese ore in return for stainless steel. The Deputy Minister of Commerce and Industry, Mr. Satish Chandra, states that similar barter deals are also being negotiated by India with other countries.

Not surprisingly, the U.S. steel strike has caused a postponement in exports of steel sheets to Russia in exchange for Russian chrome ore (*vide The Mining Journal*, July 17, p. 63, and August 7, p. 127). The Grey-Gary Corporation of New York, which recently completed an agreement to supply Russia with 30,000 tons of U.S. steel sheets annually in exchange for purchases of 350,000 tons of Russian chrome ore over the next four years, announced that its application for an export licence had been rejected by the U.S. Department of Commerce owing to the steel strike. The company was advised by the Commerce Department that the application should be resubmitted, but not earlier than 30 days after the end of the strike.

Consolidated Mines, Inc., the major producer of refractory chrome ore in the Philippines, has protested against the rejection of its product as an item exportable by barter. In a letter to the Government's National Economic Council, it was stated that many of the firm's European customers had expressed willingness to purchase Philippine refractory chrome ore provided they were allowed to pay through barter. The Council was urged to reconsider its decision.

The steel strike in the U.S. has brought business in chrome ore virtually to a standstill and buying is unlikely to show any signs of reviving until the strike is settled; this also applies to manganese ore. As to the future, much depends on how the world's steel industry shapes up in the autumn. If by that time the steel strike is over and indications, in the U.S. and elsewhere, are for a steadily expanding demand, then buying interest may be expected to quicken, especially against 1960 requirements.

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The Foote Mineral Co. has announced plans to expand its electrolytic manganese facilities by next January and has awarded contracts for new construction at the larger of its two Knoxville, Tennessee plants. The expansion, which will increase capacity by 30 per cent, is described as the first step of a major programme necessitated by the growing demand for electrolytic manganese in stainless and mild steels.

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The Showa Denko Co., a leading Japanese ferro-alloy maker, has almost completed its expansion programme for ferro-chrome production at three plants. This will result in a 100 per cent increase in the company's ferro-chrome capacity to 42,000 tonnes annually. This compares with the total Japanese output of 30,923 tonnes during the financial year ended March 31, 1959. The company's expansion programme is aimed at catching up with growing demands from the special steel making industry, particularly stainless steel makers, and an increase in exports to the U.S. market.

NICKEL STOCKPILE PURCHASES

The General Services Administration of the U.S. Government has announced that, under agreements reached with International Nickel, the government will be relieved of all existing obligations to purchase nickel from that company for the government stockpile.

Under the agreements, INCO has agreed to cancel all remaining deliveries of nickel under the company's "market price" contract. INCO has further agreed that the nickel remaining deliverable under its "premium price" contract for the production of nickel from high-cost marginal ores will be diverted into the market instead of being delivered to the government. The government will pay the company the difference between the market price and the "premium price" contracts — payment to be made in government-owned nickel oxide sinter which is in excess supply.

The GSA administrator, Mr. Floete, is reported as stating that these agreements would relieve the U.S. Government from adding approximately 13,000 s.tons of nickel to its stockpile, which already contains a surplus of this material. Furthermore, the agreements would reduce by more than $25,000,000 the amount of money the government would have been obligated to pay out in cash under these contracts. Inco's action in reaching agreement with GSA with respect to these nickel purchase contracts was described as "most co-operative and constructive".

An official of International Nickel stated that the nickel which would not be sold to the government would assist the company in expanding its market development programme in anticipation of the coming into production in 1961 of the new nickel mines in Manitoba. He added that the company was confident in its ability to sell more nickel as a result of the arrangements with the General Service Administration than if the metal were to have been delivered to the government as provided in the stockpile contracts.

KAISER'S INDIAN VENTURE

Kaiser Aluminium and Chemical Corporation and the Birla interests in India, headed by Mr. G. D. Birla, a leading Indian industrialist, have completed plans to establish an integrated aluminium producing industry in India, it has been announced. They have organized the Hindustan Aluminium Corporation Ltd., as a joint venture to construct and operate an aluminium reduction plant at Rihand, in Uttar Pradesh province in central India, together with related bauxite and alumina facilities. The plant will have an annual capacity of 20,000 tonnes of primary metal and is expected to start operations in 1962. Capital cost of the project is estimated at approximately $30,000,000. Hindustan Aluminium Corporation has applied to the U.S. Export-Import Bank for long-term dollar and rupee loans totalling $15,750,000.

The ordinary shares in Hindustan Aluminium will be held by Kaiser Aluminium, the Birla interests, and the general investing Indian public. Kaiser's share of the capital will be about 27 per cent.

Power for the alumina refining and aluminium reduction plants will be obtained from the Rihand Dam and bauxite supplies from the nearby Amarkantak area.

This development is in line with Mr. Nehru's conviction that there is a wide field for the private sector, even with the development of the public centre. Three large-scale units, which were originally to be set up in the public sector under the Second Plan, have recently been transfered to the private sector.

MAGNESIUM CONVENTION

The Hotel Roosevelt, New York will be the headquarters of the annual convention of the Magnesium Association on October 19 and 20. The theme of the Convention will be "Magnesium Techniques and Trends". Details of the programme are available from the Magnesium Association offices, 122 E. 42nd St., N.Y.17.

This event will coincide with a steady uptrend in market demand, which from all current indications promises to continue during the remainder of the year. Preliminary estimates are that first half production of primary magnesium in the U.S. amounted to about 13,000 s.tons of ingot as compared with 19,000 tons for the same period last year, reflecting the curtailed rate of output prevailing from May, 1958, to April of the current year. In May this year, however, ingot production amounted to 2,668 s.tons—an increase of 48 per cent. above the 1,808 tons produced during April. This improvement is seen as reflecting increasing demand, as well as a better inventory position.

At its annual meeting in May last year, the association unanimously agreed to accept an invitation of the Magnesium Industry Council of Great Britain to meet jointly in London in May next year, the meeting to be followed by a

series of plant visits in the Midlands.

Both technological progress and applications in Britain have been described by Mr. Jerry Singleton, executive secretary of the Magnesium Association, as outstanding. Magnesium Elektron Ltd., shares the credit for alloy development with Dow Chemical Co. in the U.S., while Rolls-Royce achieves weight savings hardly matched by aircraft engine manufacturers in the U.S. Nowhere in the world, however, is there a magnesium fabricating operation to compare with that of Volkswagenwerke in Germany, where hundreds of thousands of cars are built each year, each with an engine block consisting of two magnesium castings—an engine which weighs some 37-38 lb., but which would weigh over 100 lb. if made of iron.

COPPER · TIN · LEAD · ZINC

(From Our London Metal Exchange Correspondent)

FACTORS AFFECTING COPPER MARKET

As anticipated in last week's column, 75 per cent of the U.S. copper output is now struck but, contrary to all expectations, the London price has continued to be weak, although by Wednesday a steadier undertone had developed. The strike also covers the American Smelting and Refining Co.'s operations and at the time of writing the only large production in the U.S. is from Carteret, about which it is understood negotiations are proceeding between the Mine Mill Union and American Metal Climax. A further factor which is rendering difficult the assessment of the situation is the possibility of a waterfront strike commencing at the end of September, covering all ports from Montreal to the Gulf, and it is probably for this reason that the demand in London for nearby copper has diminished with a corresponding reduction in the backwardation.

The July consumption of copper by U.S. Domestic Brass and Wire Mills and Foundries is given by the Copper Association as 81,000 s.tons as compared with 132,702 s.tons in June: new business booked showed a substantial decrease and stocks of refined copper at the end of July totalled 518,699 s.tons as against 492,072 at the end of the previous month. These figures, taken in line with others which have become available, indicate that stocking up against a possible strike has taken place at all levels in the copper industry and this is another reason for the lack of buying interest.

The London market itself has been dominated by the liquidation of stale "bull" positions and it was only on Wednesday that this appeared to give way to covering of short sales. The market was also affected by the reduction in the backwardation and the increase in copper stocks in official warehouses, which rose by 690 tons last week just at a time when most people were expecting a further decline in view of possible shipments across the Atlantic. The European situation remains very quiet with consumers showing little interest, but this situation may change when the *force majeure* letters from American producers are received.

TIN IN GOOD DEMAND

The tin market remains featureless with the Buffer Stock Manager appearing to be a free seller of cash metal at £793: industrial demand remains at a good level. The next meeting of the International Tin Council next Tuesday may see an increase in export quotas and this may cause a temporary dip in the price, but on balance, the majority of dealers consider the price level to be still rising. Stocks in official warehouses rose by 62 tons during the week.

On Thursday the Eastern price was equivalent to £819½ per ton c.i.f. London.

EASIER TREND IN LEAD/ZINC PRICES

The lead and zinc markets have tended easier in sympathy with copper and even a rise in the American price of lead of 1 c. per lb. did not have any effect. This shows the almost complete isolation of the U.S. market as, not only was there a price rise, but also the output of lead is seriously reduced by the strike at the A.S. & R. Co's plants and in addition, there is a threat of a strike developing against the Bunker Hill Co. on August 31. Outside the U.S. the demand for zinc is maintained but there has been a little more lead on offer during the past week and it is probable that the diverging trend in the lead and zinc prices may continue. In this connection, it is to be remembered that estimates made after the Spring Meeting of the United Nations set the zinc surplus for the last six months at only 8,000 tons, whilst the lead surplus was expected to be 30,000 tons.

U.K. STATISTICS

The British Bureau of Non-ferrous Metal Statistics issue the following figures for the month of June: the corresponding May figures are shown in brackets:

Consumption of copper 56,112 (47,620); Stocks of Refined and Blister Copper at the end of June totalled 81,477 (78,505); June offtake of lead totalled 30,099 (27,280); End of month stocks were 57,810 (63,135); Usage of zinc was 30,221 (26,167); End of month stocks were 38,297 (37,713); Consumption of tin 1,987 (1,686); End of month stocks 9,638 (9,445).

Closing prices are as follows:

	Aug. 20 *Buyers*	*Sellers*	Aug. 27 *Buyers*	*Sellers*
COPPER				
Cash	£234	£235	£235½	£235½
Three months	£233	£233½	£233½	£234
Settlement	£235		£235½	
Week's turnover	11,600 tons		12,525 tons	
LEAD				
Current ½ month	£73	£73¼	£71½	£71½
Three months	£74	£74¼	£73¼	£73½
Week's turnover	10,550 tons		5,450 tons	
TIN				
Cash	£792½	£793	£792½	£793
Three months	£792½	£793	£792½	£793
Settlement	£793		£793	
Week's turnover	645 tons		505 tons	
ZINC				
Current ½ month	£86¼	£86½	£85½	£85½
Three months	£85	£85½	£84½	£84½
Week's turnover	5,050 tons		5,425 tons	

LONDON METAL AND ORE PRICES, AUG. 27, 1959

METAL PRICES

Aluminium, 99.5%, £180 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £190 per ton
Crude (70%) £190 per ton
Ore (60%) bases 19s. 6d./20s. 6d. nom. per unit, c.i.f.
Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 9s. 0d. lb.
Cerium (99%) net, £16 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt, 14s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 5d. per gram
Gold, 250s. 2d
Iridium, £23/£25 oz. nom.
Lanthanum (98/99%) 15s. per gram.
Manganese Metal (96% - 98%) £245/£250
Magnesium, 2s. 3d. lb.
Nickel, 99.5% (home trade) £600 per ton
Osmium, £21/£23 oz. nom.
Osmiridium, nom.
Palladium, £6 10s./£7 10s.
Platinum U.K. and Empire Refined £28 10s oz
Imported £26½/£27½
Quicksilver, £71½ ex-warehouse
Rhodium, £41/£45 oz
Ruthenium, £18/£20 oz. nom
Selenium, 50s. 0d. per lb.
Silver, 78¾d. f. oz. spot and 78¼d. f'd
Tellurium, 15s. lb.

ORES AND OXIDES

Bismuth		65% 8s. 6d. lb. c.i.f. 18/20% 1s. 3d. lb. c.i.f.
Chrome Ore—		
Rhodesian Metallurgical (semifriable) 48%	(Ratio 3 : 1)	£15 15s. 0d. per ton c.i.f.
" Hard Lumpy 45%	(Ratio 3 : 1)	£15 10s. 0d. per ton c.i.f.
" Refractory 40%		£11 0s. 0d. per ton c.i.f.
" Smalls 44%	(Ratio 3 : 1)	£14 0s. 0d. per ton c.i.f.
Baluchistan 48%	(Ratio 3 : 1)	£11 15s. 0d. per ton f.o.b
Columbite, 65% combined oxides, high grade		nom.
Fluorspar—		
Acid Grade, Flotated Material		£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2)		156s. 0d. ex works
Lithium Ore—		
Petalite min. 3½% Li_2O		40s. 0d./45s. 0d. per unit f.o.b. Beira
Lepidolite min. 3½% Li_2O		40s. 0d./45s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O		£25 0s. per ton f.o.b. Beira
Magnesite, ground calcined		£28 0s./£30 0s. d/d
Magnesite Raw (ground)		£21 0s./£23 0s. d/d
Manganese Ore Indian—		
Europe (46% - 48%) basis 57s. 6d. freight		nom.
Manganese Ore (43% - 45%)		nom.
Manganese Ore (38% - 40%)		nom.
Molybdenite (85%) basis		8s. 11d. per lb. (f.o.b.)
Titanium Ore—		
Rutile 95/97% TiO_2 (prompt delivery)		£29/£30 per ton c.i.f. Aust'n.
Ilmenite 52/54% TiO_2		£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)		100s. 0d./104s. 0d. per unit c.i.f.
Vanadium—		
Fused oxide 95% V_2O_5		8s./8s. 11d. per lb. V_2O_5 c.i.f
Zircon Sand (Australian) 65 - 66% ZrO_2)		£16/£17 ton c.i.f.

Mining Finance

F.S.G's Resistance Level

Whether or not Free State Geduld will break the "£10 barrier" is a question many investors must have asked themselves in recent weeks. Views on this mine, potentially the richest in the O.F.S., range from the frankly fanatic—"40 dwt. per ton by 1962" — to the vaguely pessimistic—"they've had water before and they can have it again". The recent inconclusive results from the borehole near the site of the 1A shaft have done little to resolve the various shades of opinion; indeed, the gulf between bull and bear has grown even wider, because while one school can argue that the values were disappointing in relation to the phenomenally rich reef developed from 45 level earlier this year, the other points out that twelve months ago the results would have seemed more than satisfactory.

To justify a price of £10, there would have to be conclusive evidence that at some time in the future F.S.G. will be earning sufficient after full tax and lease to pay a regular 15s. or so by way of dividend. This, in turn implies a grade of something like 33 dwt. per ton, assuming costs at their present level with throughput at 125,000 t.p.m. This is by no means impossible — even before 45 level began striking it rich there was every prospect of an eventual recovery grade of 20 dwt. Very little more than the already known areas of enrichment would be needed to raise this by 50 per cent.

Two factors, however, should be borne in mind by an investor who believes he can still see "something to go for". The first is the long period of heavy capital spending which still lies ahead. Quite apart from the question of the proposed 1A shaft, routine expenditure is still quite substantial. Moreover, it is highly probable that at some future date the decision will be taken to raise mill capacity to perhaps 140,000 tons per month. This is obviously going to defer the period of peak dividends by some years.

Again, the question of costs in the bonanza area near the 1A shaft is going to be of prime importance. The area is known to be heavily faulted, and mining conditions will be difficult. Whether they will be difficult enough to seriously reduce the profitability of the ore is a question that will only be answerable when stoping commences.

This is the evidence. The market's interim verdict seems to be that £10 represents a resistance level, which, once broken, would become no more than a milestone on the way to higher prices still. Another view, and one more in accordance with the facts as known, might be that at £9, F.S.G. is an investment; at £11 a speculation.

LONDON MARKET HIGHLIGHTS

It was hard to find any definite trend in mining markets this week. After a mixed beginning, South African golds turned easier, and much of the recent steam went out of the tin markets. Coppers, too were hesitant, while lead-zincs moved divergently.

In the Kaffir market, Monday saw the beginning of a quite sharp decline in Free State Geduld. Resulting largely from the comparatively disappointing borehole results announced on Saturday, the shares lost 4s. between Monday and Wednesday to close at 189s. 4½d. Blinkpoorts (97s. 6d.) and Ofsits (111s. 10½d.) weakened in sympathy, and even Western Holdings were affected, losing about 3s. to 173s. 3d. Other recent favourites going into reverse were West Drie, 3s. off at 165s., and Saints, 1s. 6d. down at 84s. 6d. A few counters managed to hold their own in the general dullness, among them Loraine, where continued talk of good development kept the shares firm at 37s. 3d., and Mid Wits (25s. 3d.). Welkom was in demand from time to time on hopes that the needed new capital might be raised without resort to the market.

In the finance lists, Gold Fields (80s. 6d.) were caught up in the Kaffir section's dullness after touching 83s. when full details of their bids had been published. Anglo American (196s. 3d.) was quiet, as was De Beers, 3s. off at 170s.

West African golds continued to be neglected. Ashanti lost a small amount to close at 19s. 3d., and Ariston were marginally lower in spite of a jobbers' circular outlining the prospects for the company. Exceptionally, Bibiani put on 1s. 3d., the price reaching 4s. 3d. on quite substantial buying. This was thought to stem from a reappraisal of the mine's break-up possibilities, should development continue unsatisfactory.

Copper shares moved with the metal price, reports of nationalization proposals from the Copperbelt being treated as the bluff they probably were. Messina was a particularly weak spot, closing at 104s. 4½d., compared with 111s. 3d. Continental demand enabled Bancroft (23s. 10½d.) to hold fairly steady, but Nchanga (12 5/16) were hesitant.

Tins continued to improve early in the week, but a bout of profit-taking on Tuesday and Wednesday called a halt to the recent resurgence of interest in this market. Sungei Besi (11s. 1½d.) were affected in spite of the proposed merger with Hong Fatt. Berault (32s. 3d.) and Ayer Hitam (39s. 9d.) were also marked down. Other declines of 3d. or so were recorded throughout the market on Wednesday.

In the lead-zinc section Mount Isa was weak on technical grounds and closed the week 2s. 9d. down at 44s. 6d. North Broken Hill, on the other hand, was the subject of a large buying order, putting on 2s. 6d. to 81s. 3d.

THE "NEW" KENTAN

After many years of identification with the somewhat unsuccessful Geita gold mine, Kentan Gold Areas merged with Zambesia Exploring Co. late last year. The full report and accounts for the first nine months of the "new" Kentan have now been published.

The main interests of the company remain the same as those of the old Zambesia company—the Union Minière du Haut Katanga, the Belgian Congo's giant metal producer, and the Benguela Railway, a Portuguese-registered company operating a line from the Copperbelt to Lobito Bay. Both these investments are held through the medium of Tanganyika Concessions whose accounting date is July 31, compared with March 31 for Kentan and December 31 for Union Minière and the Benguela Railway. There is, therefore, a substantial timelag element in the Kentan accounts, which means that the company's immediate future is dependent on events more than two years old.

This being so, it is easy to see why the accounts now published show results disappointing compared with those of the Zambesia company for the previous twelve months. They are, in fact, the first accounts to be affected by the sharp 1957-8 drop in the copper price. Indeed, the worst is yet to come, because although the Union Minière managed to maintain its 1958 dividend at the 1957 level of 1,500 Fr. per part social (2,300 Fr. in 1956), the Benguela Railway suffered a further decline in income and was forced to reduce its distribution to 12½ per cent from 15 per cent. It may prove possible for Tanks to maintain its reduced dividend of 3s. 3d., but certainly no improvement should be looked for.

In the longer term, of course, Kentan's future is assured by the growth in demand for copper. Although it may well take some time for the effects of oversupply to be fully worked out of the system, there can be no doubt that the overall trend is upwards. Add to this the prospect of the Benguela Railway carrying extremely large quantities of iron ore from the Cuima deposits and the present price of 40s. to yield 8½ per cent looks very reasonable.

GEEVOR'S RECORD DISTRIBUTION

Coming close after a capital return of 4s. 6d. per share, Geevor Tin has announced a final dividend of 2s. and bonus of 6d. per share, making a record total of 3s. per share for the year ended March 31 last, compared with 1s. 9d. last year. The shares are now priced at about 20s. 6d. ex return of capital, to yield more than 14 per cent on the latest distributions. Investors who bought when the shares were around 12s. at the beginning of the year are no doubt very satisfied with their choice.

The increased distribution can be construed in two ways; as recognition of the improved results for the last financial year — earnings before tax amounted to £74,534 against £59,278 — coupled with the lessening need to set aside large sums for modernization; or as a gesture of confidence in the future. Certainly Geevor's future looks unusually healthy. The tin veins currently being exploited are consistent both in width and in values. Ore reserves are increasing too, though at the cost of slowly rising development footages. Above all, modernization and reorganization are virtually complete.

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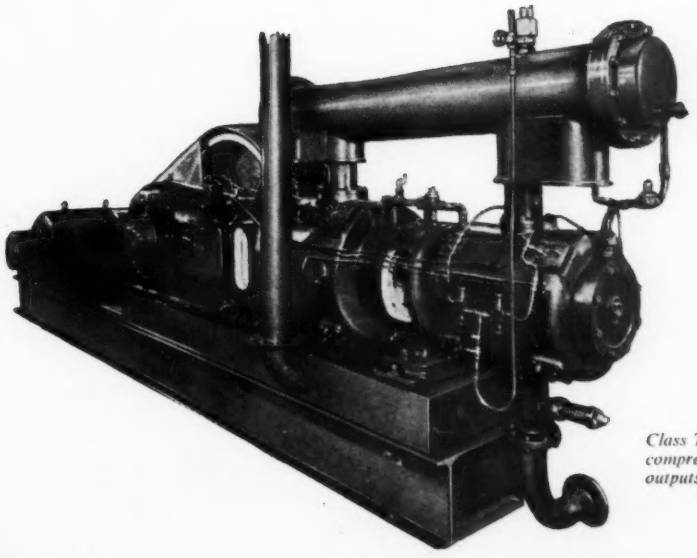

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Publications Received

In addition to the regular features, the July, 1959, issue of *Coal Age* includes the *Coal Age Mining Guidebook*, previously published separately. The result is a volume of 460 pages, of which the *Mining Guidebook* occupies over 260. It contains 16 reviews of different aspects of colliery practice, together with a Buying Directory. The publishers are the McGraw-Hill Publishing Co., Inc., 33 W. 42nd St., New York, 36, New York.

The *Year Book of the American Bureau of Metal Statistics* (50 Broadway, New York 4, N.Y.), is sponsored by the major producers of copper, lead and zinc in the U.S., Canada, Mexico, Chile and Peru. The new and further enlarged edition records for 1958 and prior years mine production, smelter production, consumption, imports and exports, and other economic statistics on a world-wide basis. Copper, lead, zinc, nickel, aluminium, bauxite, gold, silver, tin antimony, cadmium, cobalt, magnesium, molybdenum and platinum are covered statistically, together with sundry ores and metals. There are also introductory texts on the major nonferous metals, reviewing the events of 1958; tables of metal prices, monthly and annual; lists of metallurgical plants and their capacities; general economic statistics of the U.S., and U.S. duties on principal ore and metal imports.

The price is $4.50 for the hard cloth covered edition and $4.00 for the soft paper covered edition. For mailing outside the U.S., 25 c. should be added for postage and handling.

The nature of the challenge presented by the Common Market is explored in *Britain and Europe*, a book prepared by the Economist Intelligence Unit Ltd. This report was sponsored by leading industrialists, bankers and trade unionists in order to show the effect on British industry of (a) inclusion in a Western European Free Trade Area which would comprise the Common Market and the so-called Other Six, and (b) exclusion from the Common Market. Manufacturers will find in it the estimated effects of these two alternatives on the production and competitive position of their own industry and of the buyers they may be anxious to sell to. Copies may be ordered through buyers or through the Economist Intelligence Unit Ltd., 22 Ryder St., London, S.W.1. (16s. post free.)

The Inco-Mond-Wiggin organization, the largest producers of nickel and high-nickel alloys in the world, is among the world's greatest mining and metallurgical enterprises. Its activities are graphically depicted in *Pictures of an Industry*. This 36-page brochure, illustrated with reproductions in colour of paintings by Terence Cuneo, describes briefly the vast Canadian operations of the parent company, International Nickel; as well as Inco's plants and research Stations in the U.S.A., and the activities in the U.K. of Mond Nickel and its subsidiary, Henry Wiggin and Co., Ltd. By presenting an overall picture of the work of the organization as a whole, it underlines the magnitude of the operations which bring nickel to the world markets, along with the 13 other important elements recovered from the ores of Northern Ontario's "nickel region".

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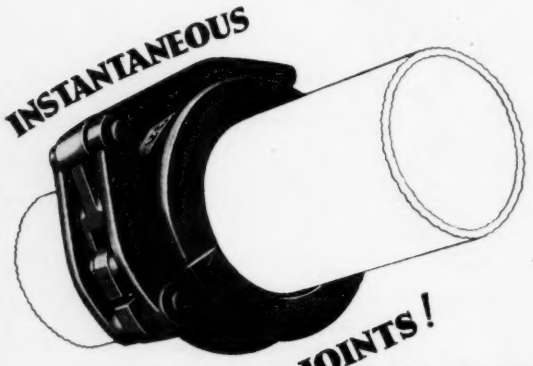
BRITISH Company operating copper/silver mines at high altitude invites applications for post of Assistant Manager. Applicants should have good qualifications and experience covering mining, metallurgy and geology. Working knowledge Spanish essential. Salary range $350-$400 per month plus bonus. Accommodation provided. Apply with copies references to Box C 659, Lee & Nightingale, Liverpool.



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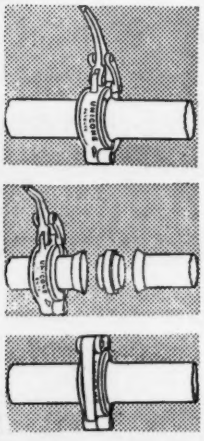

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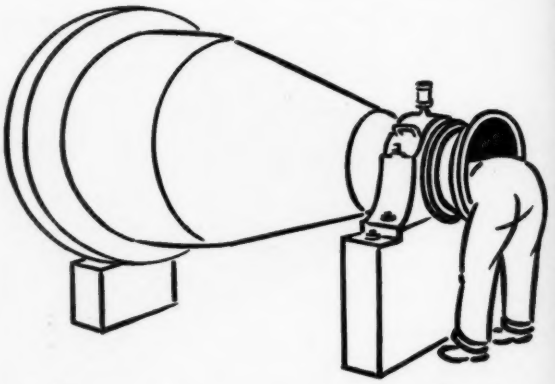

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